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## MULTIPLE SUBSCRIBER SERVICE PROFILES PER MOBILE STATION IN A CELLULAR COMMUNICATIONS SYSTEM

### BACKGROUND OF THE INVENTION

#### 5        Technical Field of the Invention

The present invention relates to cellular communications systems and, in particular, to the maintaining of multiple subscriber service profiles for a given mobile station operating within a cellular communications system.

#### 10        Description of Related Art

10        In a conventional cellular communications system, a one-to-one relationship is typically maintained between the mobile station and the subscription for that mobile station. In this regard, the "subscription" refers to the contract entered into by a user (also referred to as the "subscriber") with a cellular service provider. The subscription defines not only to whom billing for cellular services should be  
15        charged, but also sets forth the particular types of cellular calling services and features that are to be provided to the subscriber. Once the subscribed to cellular calling services and features have been defined, this data is collected in a subscriber service profile that is stored and maintained in a database. The service profile is linked in that database to an identification of the mobile station for the subscriber.  
20        Thus, the conventional system also maintains a one-to-one relationship between each mobile station and the service profile that defines the cellular services and features provided to that mobile station.

25        In most cases, there are no difficulties experienced with maintaining this one-to-one relationship between a mobile station and its associated subscription/service profile. However, situations do arise where the provision of a single subscription/service profile presents a problem. For example, many individual subscribers utilize their mobile stations for both business and personal calls. Often times the charges incurred by the subscriber for business cellular calls may be reimbursed by their employer. As only one bill is generated for the  
30        associated subscription, the subscriber must carefully review each billing statement, excise out the charges for business related calls, and submit those charges for employer reimbursement. In an analogous situation, a corporate subscriber may maintain a cellular telephone for employee use during business hours for business purposes. At the same time, however, the corporate subscriber may desire to give  
35        the using employee the privilege of access to cellular service for personal calls. Again, as only one bill is generated, some segregation of cellular service charges

must be made, and a corresponding deduction from employee pay applied for the cost of personal calls.

5 There is a need then for a technique that would not only enable a mobile station user to differentiate between business and personal calls, but also separately account for such calls in service billings.

#### SUMMARY OF THE INVENTION

10 To address the foregoing needs, a subscription for cellular service is associated with plural service profiles. Thus, a one-to-many relationship is established between a mobile station and its associated subscription/service profiles. Different billing statements for use of the same mobile station are then generated for each service profile to allow for segregated billing of service charges incurred for mobile station use.

15 The home location register (HLR) of the cellular network stores plural service profiles for such subscribed mobile stations. Each of the service profiles is associated with a different billing identification to allow service charges incurred for use of the single mobile station to be properly allocated between the different profiles. The user selects in the mobile station (MS) a particular one of the profiles to be active. At each registration, an identification of this selected service profile is sent to the serving cellular network, and the selected service profile is down-  
20 loaded from the home location register. Alternatively, the user selects the active service profile to be down-loaded from the home location register by sending a feature code to the cellular network. Furthermore, selection of the active service profile for down-loading may be made by the network in accordance with a stored schedule maintained by the home location register.

25 Charging on a per service profile basis is made for both in-coming and out-going calls. In each case, appropriate toll tickets are generated by the network. These toll tickets identify not only the subscription for the mobile station involved in the call, but also the particular active one of the plural service profiles for that mobile station to which the service charges should be applied. By processing these  
30 toll tickets, a billing center may segregate the billing of service charges incurred for mobile station use against each of the plural service profiles.

#### BRIEF DESCRIPTION OF THE DRAWINGS

35 A more complete understanding of the method and apparatus of the present invention may be acquired by reference to the following Detailed Description when taken in conjunction with the accompanying Drawings wherein:

FIGURE 1 is a schematic diagram of a cellular telephone network of the present invention;

FIGURE 2 is a node operation and signal flow diagram illustrating selection at mobile station registration between plural available service profiles;

5       FIGURE 3 is a node operation and signal flow diagram illustrating selection using a feature code transmission between plural available service profiles;

FIGURE 4 is a node operation and signal flow diagram illustrating selection according to a schedule between plural available service profiles;

10       FIGURE 5 is a node operation and signal flow diagram illustrating a first embodiment for effectuating a call set up and delivery;

FIGURE 6 is a node operation and signal flow diagram illustrating a second embodiment for effectuating a call set up and delivery;

FIGURE 7 is a flow diagram illustrating handling of an outgoing call from a mobile station associated with plural service profiles; and

15       FIGURE 8 is a flow diagram illustrating handling of an incoming call to a mobile station associated with plural service profiles.

#### DETAILED DESCRIPTION OF THE DRAWINGS

Reference is now made to FIGURE 1 wherein there is shown a schematic diagram of a cellular telephone network 10 including a plurality of interconnected switching nodes (SN) 12. Although only two switching nodes 12 are shown, it will be understood that the network 10 likely includes many more interconnected nodes. The first and second switching nodes 12(1) and 12(2) may comprise any one of a number of known telecommunications switching devices, including those commonly used and known in the art for providing either digital or analog cellular telephone service to a plurality of mobile stations (MS) 14. The switching nodes 12 are interconnected with each other for communication via both voice trunks 18 (illustrated with broken lines) and signaling links 16 (illustrated with solid lines) providing a known ISUP (or R1 or R2) type connection. The voice trunks 18 provide voice and data communications paths used to carry subscriber communications between the switching nodes 12. The signaling links 16 carry command signals between the switching nodes 12. These signals may be used, for example, in setting up and tearing down voice and data communications links over the voice trunks 18 and controlling the provision of calling services to the mobile stations 14.

35       The switching nodes 12 are also connected to a home location register (HLR) 20 through their associated visitor location register (VLR) 40 by means of

signaling links 22 providing a known Mobile Application Part (MAP) or IS-41 type connection. The home location register 20 stores information relating to the mobile stations 14 and their subscriptions comprising location information and service profile information. In connection with the present invention, as will be described  
5 in more detail below, the home location register 20 in particular stores plural service profiles for at least one of the mobile stations.

In one cellular system implementation, illustrated generally at 23, the switching node 12 is further connected to at least one associated base station controller (BSC) 24 via both a signaling link 26 and a voice trunk 28. Only one  
10 base station controller 24 is shown connected to switching node 12(2) in order to simplify the illustration. The voice trunk 28 provides a voice and data communications path used to carry subscriber communications between the second switching node 12(2) and its base station controller 24. The signaling link 26 carries command signals between the node 12 and its associated base station  
15 controller 24. The signaling link 26 and trunk 28 are collectively commonly referred to in the art as the "A interface". The base station controller 24 is then connected to a plurality of base stations (BS) 30 which operate to effectuate radio frequency communications with proximately located mobile stations 14 over an air interface 32. The base station controller 24 functions in a well known manner to  
20 control this radio frequency communications operation.

In another cellular system implementation, illustrated generally at 25, the switching node 12(1) is further connected to a plurality of base stations (BS) 30 which operate to effectuate radio frequency communications with proximately located mobile stations 14 over the air interface 32. In this implementation, the  
25 functionality provided by the base station controller 24 (see, generally at 23) is instead provided by the switching node 12(1).

Although direct communications links (signaling and/or trunk) are illustrated in FIGURE 1, it is understood by those skilled in the art that the links are not necessarily direct between the illustrated nodes, and may instead pass through  
30 many other communications nodes (not shown) of the mobile network, and perhaps even utilize other communications networks (such as the public switched telephone network - PSTN). Illustration of the links in a "virtual" manner as shown in FIGURE 1 is therefore by way of simplification of the drawing and the communications relationship between the various included nodes within the  
35 network 10.

For each cellular service subscription associated with a served mobile station 14, the home location register 20 stores service profile information 34

relating to cellular services and features subscribed to by the subscriber for that served mobile station. If conventional service is provided to a mobile station 14, the service profile information 34 associated with that mobile station subscription comprises a single service profile 36 per subscription. Conversely, and in accordance with the present invention, plural service profiles 38(n), where  $n > 1$ , may comprise the service profile information 34 associated with a single mobile station 14. For mobile stations 14 having subscriptions that support plural service profiles 38(n), any one of those plural profiles may be selected, either by the system or by the subscriber (with some restrictions), for use at a specific time or in connection with a specific call.

When a mobile station 14 makes an initial registration with the system through a particular switching node 12, that switching node requests a subscriber service profile 36 or 38(n) relating to that mobile station, and its corresponding subscription, from the home location register 20. This subscriber service profile 36 or 38(n) information is downloaded from the home location register 20 for storage in a visitor location register (VLR) 40 associated with the switching node 12. Service for both in-coming and out-going calls is then provided to the mobile station 14 by the serving switching node 12 in accordance with the downloaded service profile 36 or 38(n).

In accordance with one embodiment of the present invention, the subscriber enters a service profile selection code into the mobile station 14, and this selection information is conveyed by the serving switching node 12 to the home location register 20 at each registration. The home location register 20 processes the selection information to identify the proper one of the  $n$  available service profiles 38(n) for the mobile station 14. This profile is then downloaded to the visitor location register 40.

In another embodiment of the present invention, the subscriber sends a feature code through the mobile station 14. This feature code is indicative of the activation of a certain one of the  $n$  available service profiles 38(n) for the mobile station 14. Responsive to receipt of the feature code, the proper service profile 38(n) is identified by the home location register 20 and downloaded to the visitor location register 40. That particular service profile 38(n) is further marked as being active by the home location register 20. In response to any subsequent registration of the mobile station, the home location register 20 automatically retrieves the active one of the service profiles 38(n) for a visitor location register 40 download. Deactivation of the currently activated service profile occurs when the mobile station powers-off or when the mobile station has been idle for longer than a

predetermined time period. Alternatively, the selected service profile 38(n) continues to remain active until such time as a new selection is made through feature code entry.

5 In yet another embodiment of the present invention, the activation of a certain one of the n available service profiles 38(n) depends on a subscriber or service provider defined schedule 42 for the mobile station 14. This schedule may, for example, designate that a business related one of the service profiles 38(n) be active during weekday business hours, while a personal related one of the service profiles be active at all other times. As another application, the schedule may  
10 designate that a first employee related service profile 38(n) be active during a first weekday time shift, a second employee related service profile be active during a second weekday time shift, a third employee related service profile be active during a third weekday time shift, and that no service profile be active on weekends. No matter what the particular schedule that is established, in response to a registration,  
15 the home location register 20 identifies (based on the schedule 42) the proper active one of the n available service profiles 38(n) for the mobile station 14. This profile is then downloaded to the visitor location register 40.

In each case, a different billing identification 44(n) is provided for each of the n available service profiles 38(n) for the mobile station 14. A billing center 46  
20 for the service provider receives toll tickets (TTs) relating to calling charges, processes the toll tickets with respect to the mobile station and particular active service profile thereof, and then accordingly generates a separate billing statement for each identification 44(n) effectively allocating cellular service costs properly among various usages and subscribers. Taking, for example, the previous scenario  
25 where a business service profile 38(n) and personal service profile are provided for a single mobile station 14, one business billing statement and one personal billing statement are generated by the billing center 46. This allows the subscriber to account between business and personal calling expenses. Similarly, for the previous multi-shift related service profiles 38(n), one billing statement is  
30 generated for each weekday time shift. This allows an employer to allocate business calling expenses by shift and/or the assigned personnel. In order to generate this billing information, properly allocated to the plural service profiles, each toll ticket generated by the network 10 during a call and communicated to the billing center 46 must include information identifying the mobile  
35 station/subscription at issue, and further include information identifying, or allowing the billing center to identify, the particular one of the service profiles 38(n) that is active for the call.



Furthermore, if needed or desired, each of the plural service profiles 38(n) may be associated with a different directory number. Thus, not only is a single mobile station associated with different service profiles, but it may also be accessed by a caller through the dialing of any one of a number of different directory numbers. This allows each one of a number of potential users of the mobile station to have a unique telephone directory number for in-coming calls. In connection with the handling of such calls, a number of billing options are available. First, an in-coming call dialed to a certain directory number may be delivered to the mobile station regardless of whether the service profile associated with that number is currently active. Billing is made either to the service profile for the called number, or the service profile that is currently active. Second, the alternative holds true: no call delivery occurs unless the service profile associated with the dialed number is currently active. Billing is made to the active service profile of the called number.

Reference is now made to FIGURE 2 wherein there is shown a node operation and signal flow diagram illustrating selection at mobile station registration between plural available service profiles. The subscriber selects (action 200) a particular one of plural available service profiles 38(n) for use by making an appropriate entry into the mobile station 14. This selection is stored (action 202) by the mobile station. The mobile station 14 then makes a registration with the cellular telephone network by transmitting a registration message 204 to the serving switching node 12 through the serving base station 30 (and perhaps the serving base station controller 24). This registration message 204 includes information, perhaps stored in an included parameter, identifying the subscriber selected one of plural available service profiles 38(n). Responsive thereto, the switching node 12 sends a registration notification message 206 to the home location register 20 through the visitor location register 40 requesting the selected one of the service profiles 38(n) associated with the registering mobile station 14. The home location register 20 retrieves the selected one of the service profiles 38(n), and sends that information in message 208 back for storage (action 210) in the visitor location register 40 associated with the requesting switching node 12. In-coming and outgoing calling service is thereafter provided to the mobile station in accordance with the down-loaded service profile. If desired, the selected 200 service profile remains active until the mobile station has been idle for longer than a predetermined time period (action 212).

Reference is now made to FIGURE 3 wherein there is shown a node operation and signal flow diagram illustrating selection using a feature code transmission between plural available service profiles. A feature request is dialed

(action 220) by a subscriber into their mobile station 14. This feature request (perhaps in the form of an appropriately formatted star code) identifies a subscriber selected one of plural available service profiles 38(n) for activation, and may further present a personal identification number (PIN) indicating authorization for the selection. A feature origination message 222 is then sent by the mobile station 14 (over the air interface and through the base station) to the switching node 12. In response thereto, the switching node 12 sends a feature request message 224, including the dialed feature code, to the home location register 20. The home location register 20 then processes the message 224 to determine whether the subscriber is authorized to use the feature (action 226), and if so, what actions need to be taken in response to the request (action 228) and what instructions, if any, need to be presented to the mobile switching center to effectuate the feature (action 230). In particular, with respect to the actions 228 taken, the home location register 20 marks the subscriber selected one of plural available service profiles 38(n) as being active. A feature request return result message 232, confirming activation of the selected service profile 38(n), is then sent by the home location register 20 back to the mobile station 14 through the switching node 12. The home location register 20 also retrieves the selected one of the service profiles 38(n), and sends that information in message 234 back for storage (action 236) in the visitor location register 40 associated with the switching node 12. In-coming and out-going calling service is thereafter provided to the mobile station in accordance with the down-loaded service profile.

Once a subscriber selected one of plural available service profiles 38(n) has been marked as being active, it remains active until the mobile station powers-off (action 238), the mobile station has been idle for longer than a predetermined time period (action 240), or a new selection is made by the subscriber through feature code entry (action 220). The feature code entry (action 220) may alternatively simply de-activate the currently active service profile (taken in actions 228), with activation of a service profile requiring the entry of another feature code.

Once a service profile 38(n) is activated, it is made available at each time the mobile station 14 registers. The mobile station 14 makes a registration with the cellular telephone network by transmitting a registration message 242 to the serving switching node 12 through the serving base station 30 (and perhaps the serving base station controller 24). Responsive thereto, the switching node 12 sends a registration notification message 244 to the home location register 20 through the visitor location register 40 requesting the currently active one of the service profiles 38(n) associated with the registering mobile station 14. The home location register

20 retrieves the active one of the service profiles 38(n), and sends that information in message 246 back for storage (action 248) in the visitor location register 40 associated with the requesting switching node 12. In the event that none of the service profiles 38(n) is currently active, the home location register 20 returns a registration denied message 250 back the switching node 12. If possible, the reason for denial is conveyed to the mobile station in message 252. This prompts the subscriber to activate one of the plural service profiles 38(n) through feature code entry (action 220), resulting in a down-loading of the selected one of the service profiles 38(n) in message 234 for storage (action 236) in the visitor location register 40 associated with the switching node 12.

Reference is now made to FIGURE 4 wherein there is shown a node operation and signal flow diagram illustrating selection according to a schedule between plural available service profiles. A schedule 42 designating the activation periods for each of plural available service profiles 38(n) of a mobile station 14 is stored (action 260) in the home location register 20. The schedule 42 may be either service provider or subscriber defined. The mobile station 14 subsequently makes a registration with the cellular telephone network by transmitting a registration message 262 to the serving switching node 12 through the serving base station 30 (and perhaps the serving base station controller 24). Responsive thereto, the switching node 12 sends a registration notification message 264 to the home location register 20 through the visitor location register 40 requesting the schedule 42 defined active one of the service profiles 38(n) associated with the registering mobile station 14. The home location register 20 retrieves the service profile 38(n) identified by the schedule as being active, and sends that information in message 266 back for storage (action 268) in the visitor location register 40 associated with the requesting switching node 12. In-coming and out-going calling service is thereafter provided to the mobile station in accordance with the down-loaded service profile.

Reference is now once again made to FIGURE 1. Although not necessarily a requirement, the cellular telephone network 10 is preferably implemented as a wireless intelligent network (IN) and thus further includes at least one service control point (SCP) 48. The switching nodes 12 (also referred to as service switching points (SSPs) in this configuration) are connected to the service control point 48 by means of the signaling links 22 which utilize protocols such as Mobile Application Part (MAP), IS-41, Intelligent Network Application Part (INAP), or Transaction Capability Application Part (TCAP). The home location register 20 is preferably implemented in conjunction with the service control point 48. The

service control point 48 provides a centralized processing platform for implementing the "intelligence" of the network 10. In the context of the present invention, this intelligence comprises the administration over the plural service profiles 38(n) available to certain ones of the mobile stations 14. This administration primarily involves the operations described herein for selecting which one of the service profiles 38(n) is to be active at any one time (either in response to subscriber selection, feature code selection, or scheduling selection). Alternatively, a separate combined service switching point/service control point (SSP/SCP or SSCP) 50 is provided for handling of calls implicating multiple service profile 38(n) selection. This combined service switching point/service control point 50 is connected to the switching nodes 12 via both voice trunks 18 (illustrated with broken lines) and signaling links 16 (illustrated with solid lines) providing a known ISUP (or R1 or R2) type connection, and is connected to the home location register by means of the signaling links 22 which utilize protocols such as Mobile Application Part (MAP), IS-41, Intelligent Network Application Part (INAP), or Transaction Capability Application Part (TCAP). Although not specifically illustrated, it is understood that the intelligent network further includes intelligent peripherals (IPs) and other nodes as needed to implement in a known manner any desired intelligent network services.

Reference is now made to FIGURE 5 wherein there is shown a node operation and signal flow diagram illustrating a first embodiment for effectuating a call set up and delivery. A call 300 dialed to the directory number (B-number) of a mobile station 14 originates from another cellular subscriber or the public switched telephone network (PSTN), and is received at a first (originating or gateway) switching node 12(1). The originating switching node 12(1) determines whether the calling party is entitled to receive any intelligent network services (action 302). One such service may comprise the plural service profile 38(n) service of the present invention. If so, the originating switching node 12(1) sends an originating access message 304 to the home location register 20 (service control point 48). This message 304 requests an identification of each intelligent network service to which either the calling party is entitled. The list of such services (including, for example, the plural service profile 38(n) service) is returned to the originating switching node 12(1) in message 306. The identified services in the returned list are then evaluated and organized (action 308) for implementation in connection with the call 300.

With respect to call handling in the context of the plural service profile 38(n) service of the present invention, the call is routed 310 to the particular

combined service switching point/service control point 50 supporting that service (assuming the home location register 20 cannot provide all necessary support, including billing). In this regard, the combined service switching point/service control point 50 has knowledge (perhaps down-loaded from, or accessed from the home location register 20) of the plural service profiles 38(n) associated with the calling/called party. The active one of the plural service profiles 38(n) is then implemented (action 312) in connection with the call, and a toll ticket for billing is generated 314 specifically identifying the active profile of a given subscription be charged. The call is then routed 316 back to the originating switching node 12(1). As a further refinement of the call handling process, the call leg routings 310 and 316 may be dropped (if desired), as generally indicated with "X" markings, from the call 300 once generation 314 of the toll ticket associating the call with the proper service profile is completed. Another toll ticket for billing is then generated 318 by the originating switching node 12(1) identifying that the given subscription be charged. These toll tickets are processed by the billing center 46 to generate a charge for the call, with that charge being assessed against the currently active one of the service profiles 38(n) of the calling party subscription. As another refinement, the billing information relating to the active service profile 38(n) is sent to the originating switching node 12(1) to be included in its generated 318 toll ticket, thus obviating the need for a separate toll ticket generated 314 by the service switching point/service control point 50.

Now that the appropriate one of the plural service profiles 38(n) has been associated with the call, and following the actuation of any other appropriate intelligent network services in connection with the call, the originating switching node 12(1) interrogates the home location register 20 with a location request (send routing) message 320. The location request (send routing) message 320 is processed by the home location register 20 to determine the location (i.e., second or serving switching node 12(2)) within the cellular network 10 of the called mobile station 14. Responsive to this interrogation, the home location register 20 messages the serving switching node 12(2) for the called mobile station 14 with a routing request (provide roaming) message 322 to prepare for the call. The serving switching node 12(2) then determines in action 324, to some selected degree of granularity, the location (for example, location area) of the called mobile station 14. This location may be identified, for example, based on information resulting from a most recent registration (not shown) of the called mobile station 14 as stored in the visitor location register (not shown) associated with the serving switching node 12(2). Alternatively, the serving switching node 12(2) may page (not shown) the

called mobile station 14, and process the page response (not shown) to make a more precise location determination. In accordance with this determined location, the serving switching node 12(2) selects in action 326 an appropriate routing number (for example, a temporary location directory number (TLDN) or a roaming number) for that location. In this instance, the routing number is selected from a plurality of such numbers associated with the serving switching node 12(2). The selected routing number is then returned 328 to the originating switching node 12(1) via the home location register 20. The incoming call is then delivered (through connected) 330 to the serving switching node 12(2) using the routing number for attempted completion to the called mobile station 14. Completion of the call involves further routing 332 the incoming call to the currently serving base station 30 (perhaps through the base station controller 24), and then to the called mobile station 14 over the air interface 32. The serving switching node 12(2) handles the call in accordance with the down-loaded, visitor location register stored, service profile of the called mobile station. It is recognized that this down-loaded service profile may comprise one of a number of service profiles 38(n) assigned to the called mobile station 14 subscriber and currently designated as active (see, FIGURES 2, 3 and 4). A toll ticket (TT) is accordingly generated (action 334) against the active one of the service profiles for the called mobile station. Toll ticket processing enables the billing center 46 to properly generate a charge for the call, with that charge being assessed against the currently active one of the service profiles 38(n) of the called party subscription.

Reference is now made to FIGURE 6 wherein there is shown a node operation and signal flow diagram illustrating a second embodiment for effectuating a call set up and delivery. A call 300 dialed to the directory number (B-number) of a mobile station 14 originates from another cellular subscriber or the public switched telephone network (PSTN), and is received at a first (originating or gateway) switching node 12(1). The originating switching node 12(1) determines whether the calling party is entitled to receive any intelligent network services (action 302). One such service may comprise the plural service profile 38(n) service of the present invention. If so, the originating switching node 12(1) sends an originating access message 304 to the home location register 20 (service control point 48). This message 304 requests an identification of each intelligent network service to which either the calling party is entitled. The list of such services (including, for example, the plural service profile 38(n) service) is returned to the originating switching node 12(1) in message 306. The identified services in

the returned list are then evaluated and organized (action 308) for implementation in connection with the call 300.

5 Routing of the call to a service switching point/service control point 50 is not required in this embodiment as the home location register 20 (service control point 48) support all aspects (including billing) for the plural service profile 38(n) service of the present invention. Thus, responsive to the originating access message 304, the active one of the plural service profiles 38(n) is then implemented (action 312') in connection with the call, and a toll ticket for billing is generated 314' specifically identifying that the specific active profile of a subscription be charged. Another toll ticket for billing is then generated 318 by the originating switching node 12(1) identifying that the subscription be charged. These toll tickets are processed by the billing center 46 to generate a charge for the call, with that charge being assessed against the currently active one of the service profiles 38(n) of the identified calling party subscription. As a refinement to the process, 15 the billing information relating to the active service profile 38(n) is sent to the originating switching node 12(1) to be included in its generated 318 toll ticket, thus obviating the need for a separate toll ticket generated 314' by the home location register 20.

20 Now that the appropriate one of the plural service profiles 38(n) has been associated with the call, and following the actuation of any other appropriate intelligent network services in connection with the call, the originating switching node 12(1) interrogates the home location register 20 with a location request (send routing) message 320. The location request (send routing) message 320 is processed by the home location register 20 to determine the location (i.e., second or serving switching node 12(2)) within the cellular network 10 of the called mobile station 14. Responsive to this interrogation, the home location register 20 messages the serving switching node 12(2) for the called mobile station 14 with a routing request (provide roaming) message 322 to prepare for the call. The serving switching node 12(2) then determines in action 324, to some selected degree of 25 granularity, the location (for example, location area) of the called mobile station 14. This location may be identified, for example, based on information resulting from a most recent registration (not shown) of the called mobile station 14 as stored in the visitor location register (not shown) associated with the serving switching node 12(2). Alternatively, the serving switching node 12(2) may page (not shown) the 30 called mobile station 14, and process the page response (not shown) to make a more precise location determination. In accordance with this determined location, the 35 serving switching node 12(2) selects in action 326 an appropriate routing number

(for example, a temporary location directory number (TLDN) or a roaming number) for that location. In this instance, the routing number is selected from a plurality of such numbers associated with the serving switching node 12(2). The selected routing number is then returned 328 to the originating switching node 12(1) via the home location register 20. The incoming call is then delivered (through connected) 330 to the serving switching node 12(2) using the routing number for attempted completion to the called mobile station 14. Completion of the call involves further routing 332 the incoming call to the currently serving base station 30 (perhaps through the base station controller 24), and then to the called mobile station 14 over the air interface 32. The serving switching node 12(2) handles the call in accordance with the down-loaded, visitor location register stored, service profile of the called mobile station. It is recognized that this down-loaded service profile may comprise one of a number of service profiles 38(n) assigned to the called mobile station 14 subscriber and currently designated as active (see, the process of FIGURES 2, 3 and 4). A toll ticket (TT) is accordingly generated (action 334) against the active one of the service profiles for the called mobile station. Toll ticket processing enables the billing center 46 to properly generate a charge for the call, with that charge being assessed against the currently active one of the service profiles 38(n) of the called party subscription.

Reference is now made to FIGURE 7 wherein there is shown a flow diagram illustrating handling of an outgoing call from a mobile station associated with plural service profiles. In step 100, a call origination is received by the process. This received call origination 100 includes an identification of digits dialed for an outgoing call and/or code dialings. A determination is then made in step 102 as to whether the received call concerns a user designated and transmitted activation (feature) code. If yes, an appropriate action is taken in step 104 in response to the code. For example, the sent code may identify a subscriber selected one of plural available service profiles 38(n) for activation (see, FIGURE 3). Other actions relevant to the plural service profile 38(n) service of the present invention and involving a feature code selection are presented below. It should further be noted that a specific feature code may be recognized that would prevent unauthorized entry of feature codes to specify certain actions and changes. An appropriate confirming announcement with respect to the action (such as confirming the selection of a certain service profile) is then sent back to the mobile station in step 106, and the call is terminated. If no, a determination is then made in step 108 as to whether the received call concerns a user designated and transmitted escape code. This escape code signals the process to switch between



available service profiles 38(n) for a current call only. This differs from the activation code of step 102 where a semi-permanent switch of service profiles may be made. Accordingly, if yes, a toggle is set in step 110. Thereafter, or if no in step 108, a determination is made in step 114 as to whether a scheduling feature (42, FIGURE 1) for the user is currently enabled. The scheduling feature enables the user (or the subscriber, if different) to select based on time of day, and day of week parameters, which of the plural service profiles 38(n) is to be active. If the scheduling feature is enabled, then the appropriate one of the service profiles based on the schedule is selected in step 116 to be implemented in connection with the call. Through the use of an appropriate activation (feature) code (step 102), the user may selectively choose not to have an established schedule be activated and followed. In the event the schedule designates the current time of day and day of week are black-out periods for user originated calls, an appropriate confirming announcement with respect to the black-out is then sent back to the mobile station in step 106, and the call is terminated. If no (in step 114), the default one of the plural service profiles 38(n) for the user, or the user activated one of the plural service profiles (step 104), is selected in step 118 to be implemented in connection with the call. Following selection of a service profile (116 or 118), a determination is made in step 120 as to whether the toggle was previously set in step 110. If yes, the service profile effective for the call is switched in step 122 from that selected in steps 116 or 118, to one of the other service profiles for the duration of the current call only. Thereafter, or if no in step 120, the call is screened in step 124 according to the active service profile in order to determine if call completion is permitted. In this regard, there are two kinds of screening lists that are implemented for each of the service profiles. The first is an outgoing allowed list. If the dialed digits (step 100) meet the parameters of the allowed list, call completion is permitted. Charging for the call is then made against the active service profile in step 126 and the call is completed 128. The second is an outgoing restricted list. If the dialed digits (step 100) meet the parameters of the restricted list, call completion is rejected in step 130. An appropriate confirming announcement with respect to the restriction is then sent back to the mobile station in step 106, and the call is terminated.

Reference is now made to FIGURE 8 wherein there is shown a flow diagram illustrating handling of an incoming call to a mobile station associated with plural service profiles. In step 200, an incoming call is received dialed to a particular directory number (i.e., the B number). A determination is then made in step 202 as to which of a number of available profiles is currently in effect. This

determination may be made by having a different profile 38 associated with each B number, and thus selecting the profile for the dialed B number. In accordance with the present invention, the determination is made by having multiple profiles 38(n) associated with each individual B number, and then selecting that profile which is either currently selected by the called subscriber as being active or is active based on a schedule. The process then selects the proper profile 38(n) in step 204.

Once the proper profile 38(n) has been determined and selected, the process next screens against the calling party telephone number (i.e., the A number) in step 206. This screening process is performed against a list of A number from which it is permissible for the called mobile station to receive an incoming call. The list can be as specific as including particular numbers, or a general as including broad source indications (like prefixes and area codes). If the A number is not authorized by the list, the incoming call is rejected in step 208. If the A number is on the list, the incoming call is next processed through a diversion selection function in step 210.

With respect to the diversion selection function, the process may implement location based diversion in step 212. In accordance with location base diversion, the incoming call is diverted for call delivery based on called mobile station location. A number of different diversion options are available contingent on mobile station roaming status. The subscriber may, for example, specify delivery of the call to the mobile station, or alternatively delivery to a forwarding directory number (C number). The selection of one delivery option over another option depends upon the current roaming status (public or private network) of the mobile station in combination with the options specifically assigned by the subscriber for that status.

The process of diversion selection may further implement a mobile status based diversion in step 214. In accordance with mobile status based diversion, the incoming call is diverted for call delivery based on called mobile station operational status. A number of different diversion options are available contingent on mobile station operational status. The subscriber may, for example, designate the mobile station itself as the first point of contact as long as the mobile station is currently in active operational mode. If the mobile station is currently in inactive operational mode, however, the incoming call is instead routed in accordance with a diversion routing in step 216. Furthermore, if the mobile station is currently active, but is busy or there is no answer to the incoming call alert, the incoming call is again instead routed in accordance with the diversion routing of step 216.

The diversion routing of step 216 specifies the manner with which call delivery is to be accomplished. As a general rule, this manner of accomplishing call delivery is specified by the subscriber based on the currently effective operation status of the called mobile station at the time of delivery. For example, if the current status of the mobile station is either inactive, busy or no answer, diversion routing may specify forwarding of the incoming call to a certain directory number (perhaps, comprising a voice mail box for the subscriber or other selected C number). Optionally, other delivery mechanisms may be employed. Examples of these mechanisms include sequential paging, sequential time based paging, or called party controlled completion (CPCC) services. Sequential paging refers to a delivery mechanism where a list of forwarding numbers to be sequentially tried is maintained to handling step 216 diversion routing instances. If one of the numbers on the list is busy, the call is routed to an identified end of list destination (typically comprising a voice mail box). If the last number on the list is reached without completing a successful call set-up, then the call is also routed to an identified end of list destination. Furthermore, if a time out occurs without making a successful call set-up, then the call is also routed to an identified end of list destination. Sequential time based paging refers to a delivery mechanism use of certain one or more of the numbers on the list is restricted in time. For example, a business hours dialing list and a non-business hours dialing list may be maintained. Thus, certain numbers are effective only at certain times of the day (or perhaps day of the week), and those effective numbers are sequentially tried during step 216 diversion routing. Called party controlled completion refers to a delivery mechanism where the called party exercises control over how an incoming call is to be handled (such as, for example, transfer to voice mail, forward to alternate number, and the like).

Once A number screening and diversion function have been performed, the process moves to charge for the incoming call against the active service profile in step 218 and the call is completed 220. It is recognized that in some instances completion of the call will not occur, the process accordingly returns (also dotted path 222) back to the diversion function 210 for further handling. Such handling may, for example, comprise retrieving a different forward to number in the case of the sequential call delivery mechanism.

Although preferred embodiments of the method and apparatus of the present invention have been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements,

**modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.**

**WHAT IS CLAIMED IS:**

1. A cellular telephone system serving a plurality of mobile stations, comprising:

5 at least one home location register storing service profile information for each of the served mobile stations, wherein the stored service profile information comprises plural different service profiles maintained for each of certain ones of the mobile stations.

10 2. The system as in claim 1 wherein each of the plural different service profiles maintained for each of the certain ones of the mobile stations has a billing identification in order to allow for segregated billing by service profile of service charges incurred with respect to use of the certain mobile stations.

3. The system as in claim 1 further comprising means for selecting an active one of the plural different service profiles for application in providing cellular telephone service to the certain mobile station.

15 4. The system as in claim 3 wherein the means for selecting comprises a schedule that identifies which of the plural different service profiles is to be active at any given time.

20 5. The system as in claim 3 wherein the means for selecting comprises a feature code selection that identifies which of the plural different service profiles is to be active at any given time.

6. The system as in claim 3 wherein the means for selecting comprises a default selection that identifies which of the plural different service profiles is to be active.

25 7. A method for providing cellular telephone service to a mobile station, comprising the steps of:  
storing for that mobile station a plurality of different service profiles; and  
activating a certain one of the plurality of different service profiles for application in providing cellular telephone service to the certain mobile station.

30 8. The method as in claim 7 wherein the step of storing comprises the step of maintaining a billing identification for each of the plural service profiles in

order to allow for segregated billing by service profile of service charges incurred with respect to use of the mobile station.

9. The method as in claim 7 wherein the step of activating comprises the steps of:

5        establishing an activation schedule defining times when each of the plural service profiles is to be active for application in providing cellular telephone service to the certain mobile station; and

          activating ones of the plural service profiles in accordance with the established schedule.

10        10. The method as in claim 7 wherein the step of activating comprises the steps of:

          selecting by a user of the mobile station of a certain one of the plural service profiles to be active for application in providing cellular telephone service; and

15        communicating that selection at mobile station registration to activate the certain service profile.

11. The method as in claim 10 wherein the step of activating further comprises the step of maintaining the certain service profile as active until the expiration of a predetermined time period.

20        12. The method as in claim 7 wherein the step of activating comprises the steps of:

          making a feature code selection identifying a certain one of the plural service profiles to be active for application in providing cellular telephone service; and

          sending that feature code to activate the certain service profile.

25        13. The method as in claim 12 wherein the step of activating further comprises the step of maintaining the certain service profile as active until the expiration of a predetermined time period.

30        14. The method as in claim 7 wherein the step of activating comprises the step of activating a designated default one of the plural service profiles for application in providing cellular telephone service.

15. A method for handling a call origination in a cellular telephone system, comprising the steps of:

determining if a calling party is entitled to utilize a plural service profiles per subscriber service;

5 if yes, determining which one of the plural service profiles for the calling party is currently active;

applying the currently active one of the plural service profiles to the call origination; and

10 billing service charges for the call origination against the currently active service profile.

16. The method as in claim 15 wherein the step of determining comprises the step of choosing the one of the plural service profiles selected by the calling party.

15 17. The method as in claim 15 wherein the step of determining comprises the step of choosing the one of the plural service profiles dictated by a schedule.

18. The method as in claim 17 further including the step of rejecting the call origination if the schedule indicates that a call black-out period is currently in effect.

20 19. The method as in claim 15 wherein the step of determining comprises the step of choosing a default one of the plural service profiles.

25 20. The method as in claim 15 wherein the step of billing comprises the step of generating at least one toll ticket for the call origination that identifies not only the calling party but also the active one of the plural service profiles for that calling party.

21. The method as in claim 15 further including the steps of:  
screening a called number for the call origination against a screening list associated with the active one of the plural subscriber profiles; and  
permitting the call origination if the step of screening is passed.

22. A method for handling a call delivery in a cellular telephone system, comprising the steps of:

determining if a called party is entitled to utilize a plural service profiles per subscriber service;

5 if yes, determining which one of the plural service profiles for the called party is currently active;

applying the currently active one of the plural service profiles to the call delivery; and

10 billing service charges for the call delivery against the currently active service profile.

23. The method as in claim 22 wherein the step of determining comprises the step of choosing the one of the plural service profiles selected by the called party.

24. The method as in claim 22 wherein the step of determining  
15 comprises the step of choosing the one of the plural service profiles dictated by a schedule.

25. The method as in claim 22 further including the step of applying diversion in connection with delivery of the call to a particular forward to number based on current called mobile station location.

20 26. The method as in claim 22 further including the step of applying diversion in connection with delivery of the call to a particular forward to number based on called mobile station status.

27. The method as in claim 22 further including the step of completing the call.

25 28. An intelligent network implementation for a cellular telephone system, comprising:

an originating switching node receiving a call from a calling party, the originating node detecting whether the calling party is subscribed to a plural service profiles per subscriber service; and

30 a service switching point/service control point (SSCP) through which the call is routed by the originating switching node if the calling party is subscribed



to the plural service profiles per subscriber service, the service switching point/service control point determining which one of the plural service profiles for the calling party is currently active, and generating a toll ticket for the call to be applied against the currently active service profile for the calling party.

5           29.    The system as in claim 28 further including:

          a home location register connected to the originating switching node, the home location register storing information concerning the plural service profiles for the calling party;

          wherein the originating switching node determines whether the calling party  
10       is subscribed by querying the home location register storing the plural service profiles information.

          30.    The system as in claim 28 further including a billing center for collecting toll tickets for calls and generating segregated billing of service charges incurred with respect to use of each service profile for the calling party.

15           31.    The system as in claim 28 further including a destination switching node serving a called party for the call, wherein the called party is subscribed to the plural service profiles per subscriber service, and the destination switching node serving the called party in accordance with a currently active one of the plural  
20       service profiles for the called party, and generating a toll ticket for the call to be applied against the currently active service profile for the called party.

          32.    The system as in claim 31 further including:

          a visitor location register connected to the destination switching node, the visitor location register storing information concerning the currently active one of the plural service profiles for the called party.

25           33.    An intelligent network implementation for a cellular telephone system, comprising:

          an originating switching node receiving a call from a calling party, the originating node detecting whether the calling party is subscribed to a plural service profiles per subscriber service; and

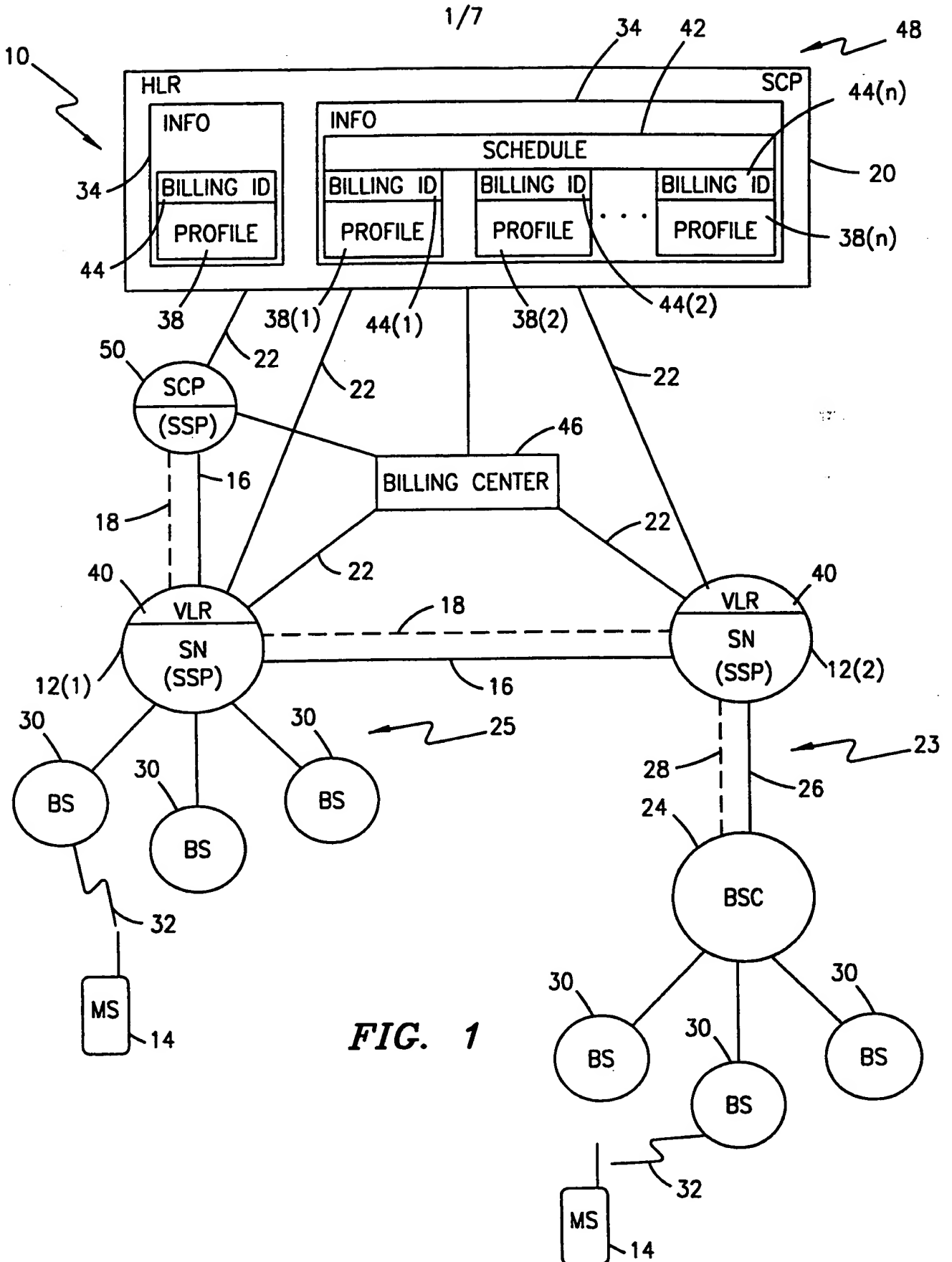
30           a home location register/service control point (HLR/SCP) connected to the originating switching node, the home location register storing information concerning the plural service profiles for the calling party, the home location

5 register/service control point further being queried by the originating switching node to detect the calling party subscription to the plural service profiles per subscriber service, the home location register/service control point still further determining which one of the plural service profiles for the calling party is currently active, and generating a toll ticket for the call to be applied against the currently active service profile for the calling party.

34. The system as in claim 33 further including a billing center for collecting toll tickets for calls and generating segregated billing of service charges incurred with respect to use of each service profile for the calling party.

10 35. The system as in claim 33 further including a destination switching node serving a called party for the call, wherein the called party is subscribed to the plural service profiles per subscriber service, and the destination switching node serving the called party in accordance with a currently active one of the plural service profiles for the called party, and generating a toll ticket for the call to be  
15 applied against the currently active service profile for the called party.

36. The system as in claim 35 further including:  
a visitor location register connected to the destination switching node, the visitor location register storing information concerning the currently active one of the plural service profiles for the called party.



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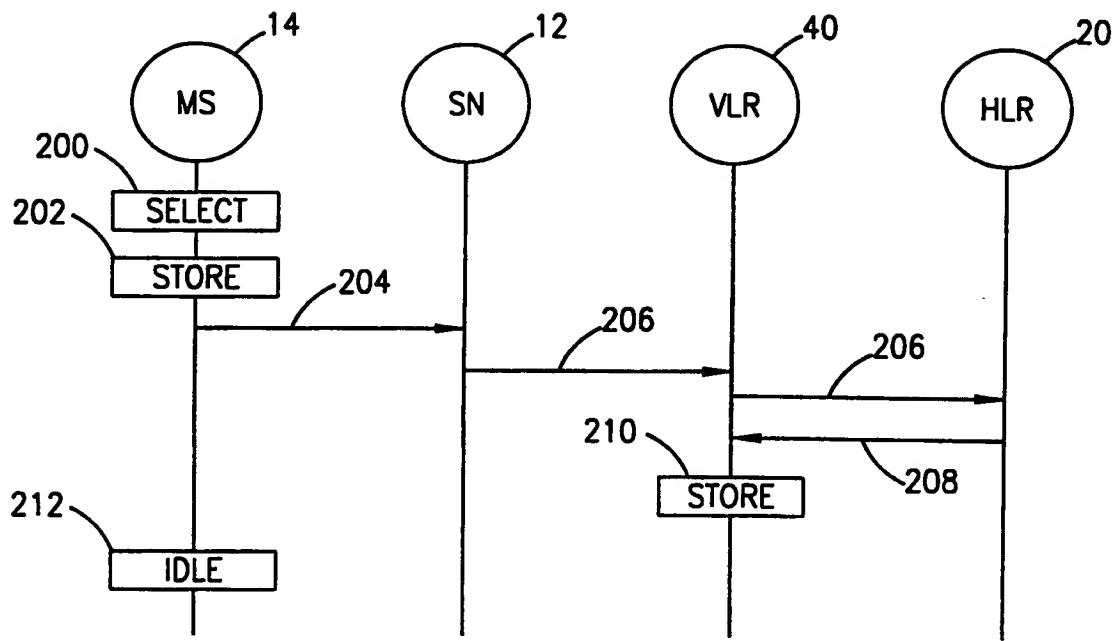


FIG. 2

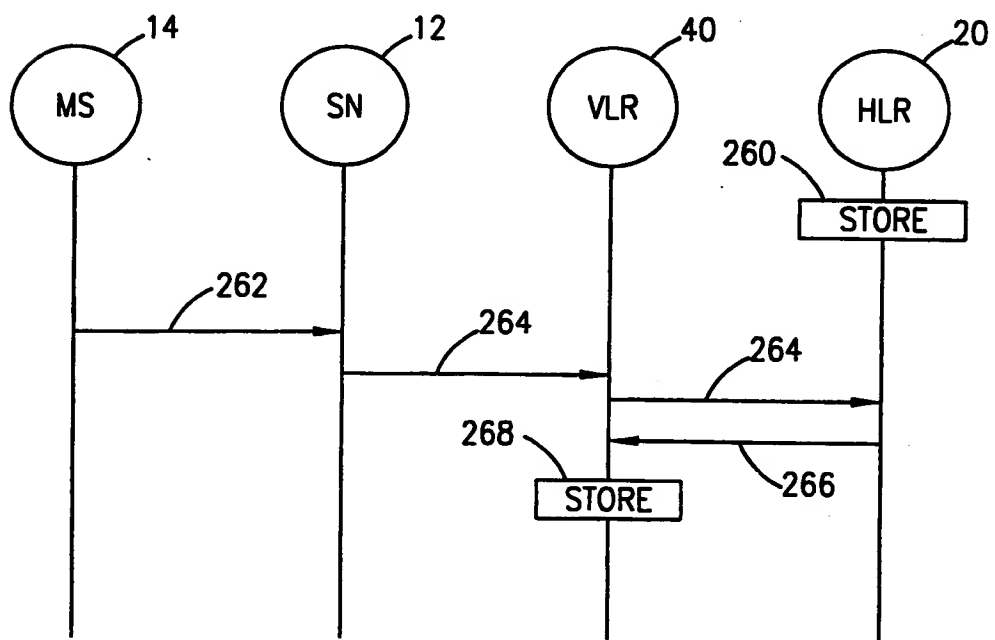
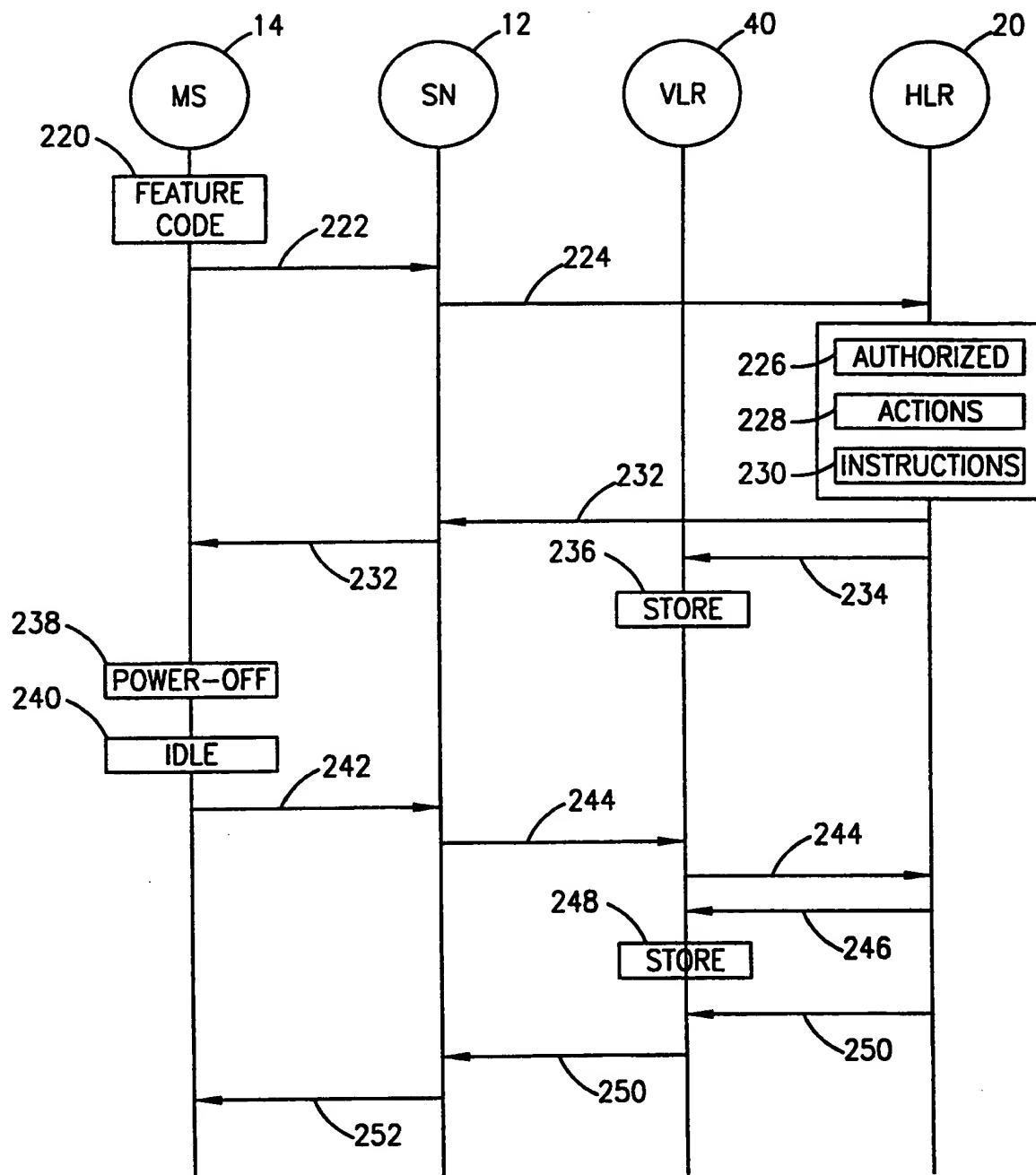


FIG. 4

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**FIG. 3**

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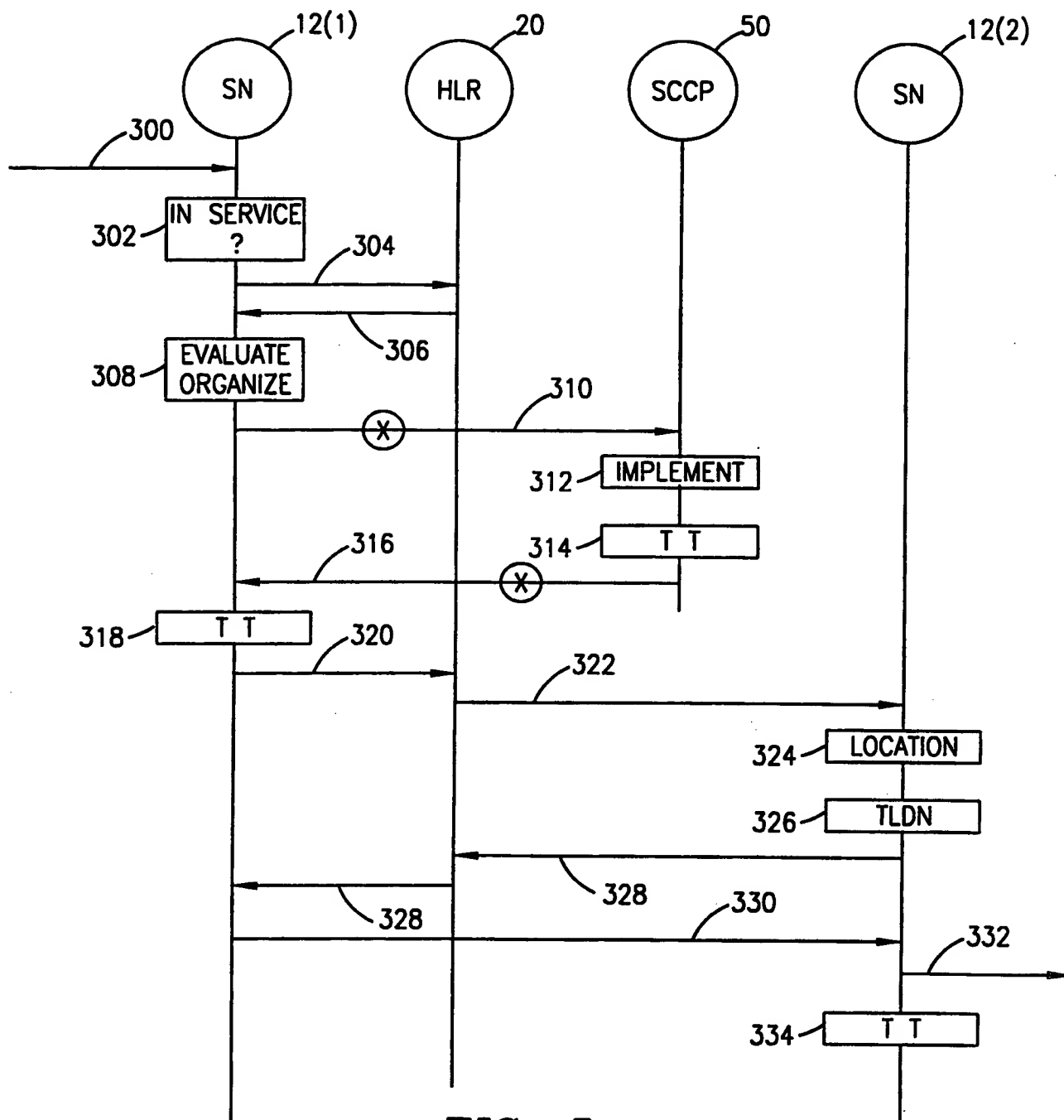


FIG. 5

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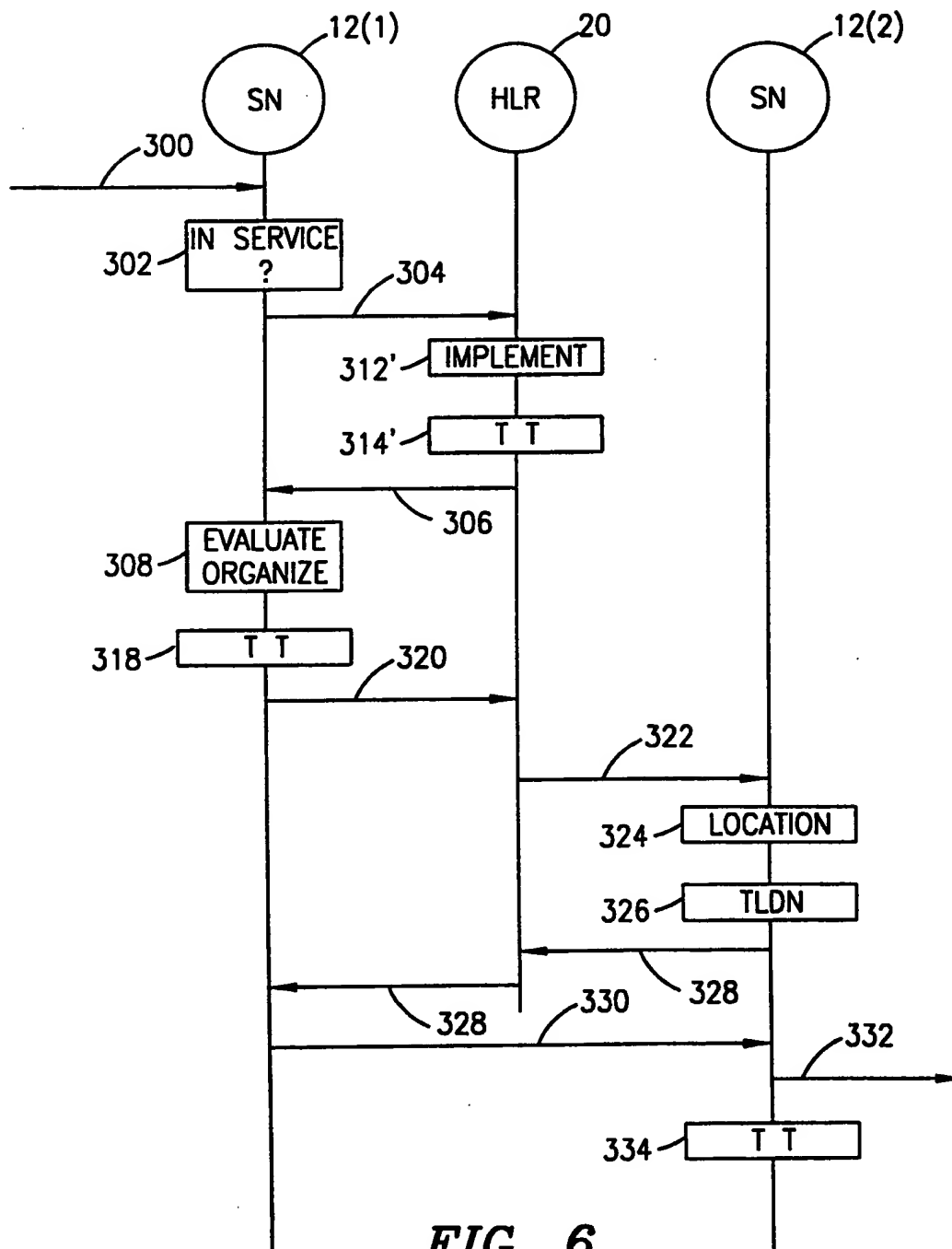


FIG. 6

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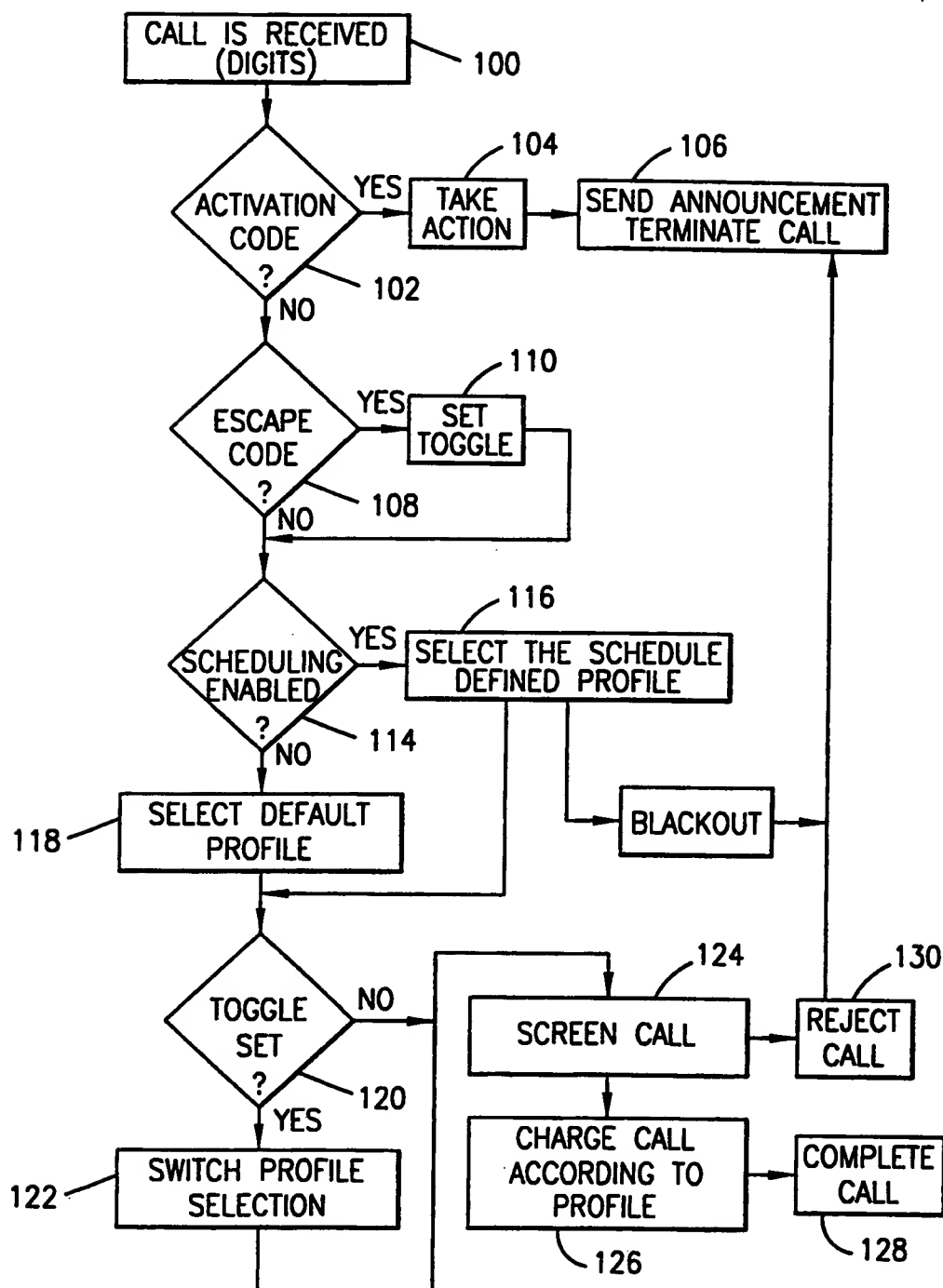


FIG. 7



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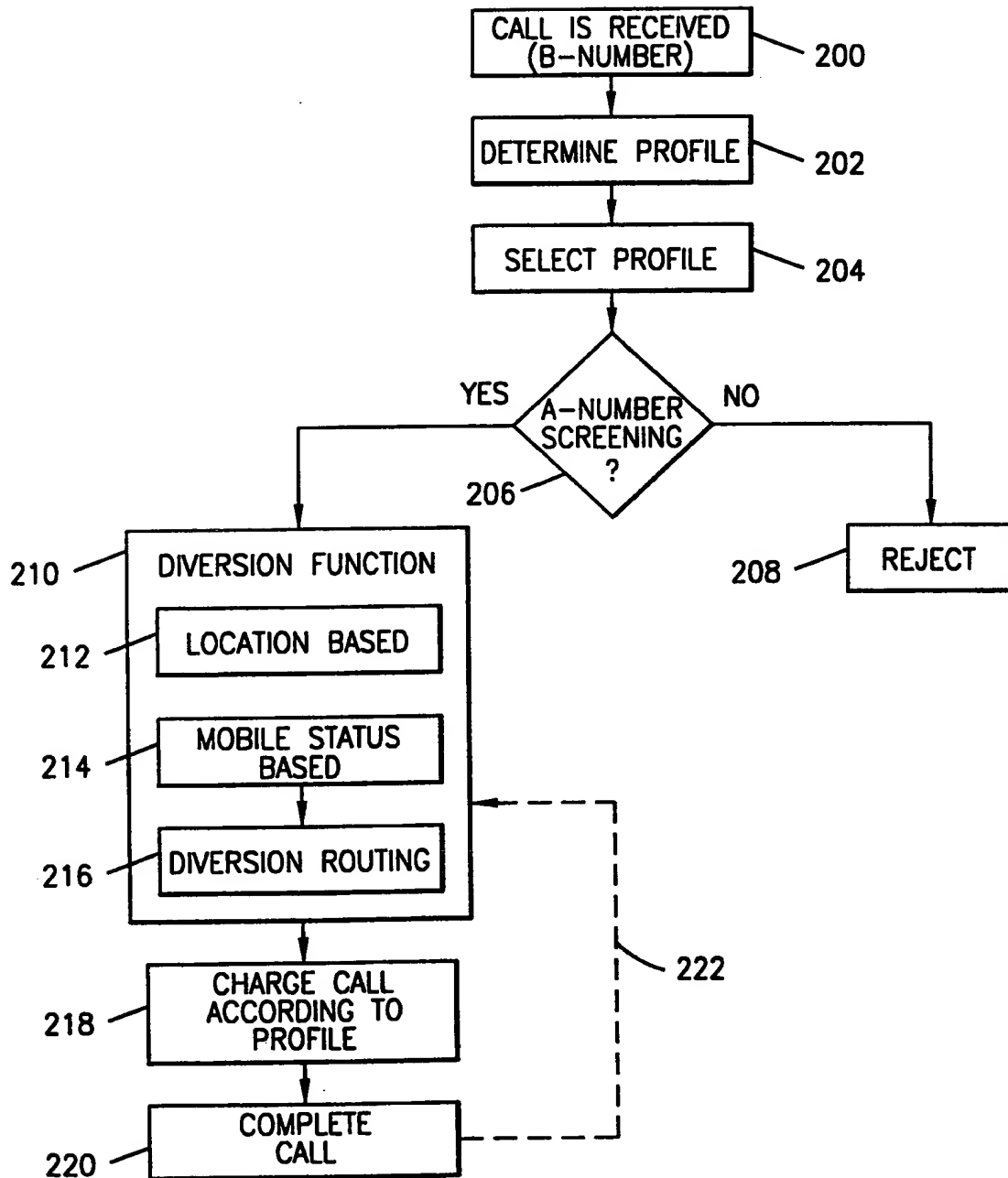


FIG. 8

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/SE 98/02111

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04Q7/22 H04M15/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 561 706 A (FENNER PETER R) 1 October 1996	1-3, 5, 7, 8, 12, 15, 16, 20-23, 27-36
A	see column 2, line 28 - column 5, line 59	9, 10, 17, 18
Y	WO 97 30559 A (ERICSSON GE MOBILE INC) 21 August 1997	1-3, 5, 7, 8, 12, 15, 16, 20-23, 27-36
A	see page 7, line 14 - page 19, line 4 -/--	13, 25, 26

☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

28 January 1999

Date of mailing of the international search report

05/02/1999

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# INTERNATIONAL SEARCH REPORT

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>SHERBURNE T J ET AL: "TIME ACTIVATED SUBSCRIBER PRIVILEGES" MOTOROLA TECHNICAL DEVELOPMENTS, vol. 25, 1 July 1995, page 59 XP000524341 see the whole document -----</p>	

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/SE 98/02111

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5561706	A	01-10-1996	NONE	
WO 9730559	A	21-08-1997	US 5815808 A	29-09-1998
			AU 2204197 A	02-09-1997
			EP 0882374 A	09-12-1998

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